May 11, 1847.

William Spence, Esq., F.R.S., in the Chair.

The following paper was communicated to the Meeting:—

ON THE GENERA OF THE FAMILY CHITONIDÆ. BY J. E. GRAY, ESQ., F.R.S., F.Z.S. ETC.

This family now contains so many species, offering such varied modifications of form and structure, that it becomes necessary to separate it into several genera, for the purpose of more accurately determining the species and showing their relations to each other.

Most authors have regarded the family as a single genus, and even M. De Blainville, who formed the family into a class under the name of *Polyplakiphora,* so regarded them. He forms of this class and his *Nematopodes* or Barnacles a subtype of the animal kingdom, which he called *Malentozoaria* or *Molluscarticulata*; but there is no sufficient character to separate the Chitons from the other Mollusca, and the *Nematopodes* are now known to be *Crustacea,* so that this division or subtype of the animal kingdom has been erased from the system by most succeeding authors.

Dr. Leach in his MSS. proposed to divide this family into genera, according to the form of the appendages which cover the upper surface of the mantle; and Risso, who was in constant correspondence with Dr. Leach, has in his work published two of Dr. Leach's genera. Mr. Guilding has formed some genera on the same principles in the Zoological Journal, and I have added two others in the Synopsis of the British Museum for 1841.

I may remark that these appendages of the mantle form exceeding good characters for the more minute division of the groups, but the scales so gradually pass into spines or tubercles on the one side, and on the other they so gradually diminish in thickness to furfuraceous scales, which are easily deciduous that it is difficult to define when they are quite absent; therefore they do not afford characters of sufficient importance to use them as Leach, Risso and Guilding have done, for the primary divisions of the family.

Lamarck divided the family into two genera, *Chiton* and *Chitonellus,* but he left in the former genus several species which are more naturally allied to the latter.

M. De Blainville in 1825 published a monograph of the family, under the article 'OSCABRION' in the Dict. Sci. Nat. xxxvi., in which he introduced some new characters for the division of the species into sections. He observes: "Les organes sur lesquels nous appellerons successivement l'attention pour le distinction des espèces sont les suivants:—

"1. L'existence ou l'absence des paires de pinceau de soies disposés bien regulièrement de chaque côte du limbe, qu'il soit revêtu ou non d'écailles, d'épines, ou même de poils.

" 2. La disposition des branches commençant plus ou moins en arrière et se terminant plus ou moins en avant.

" 3. La forme de valves de la coquille, considérée spécialement dans l'existence plus ou moins marqué des aires latérales.

" 4. La grandeur proportionnelle de ces valves et leur dégré d'occlusion.

" 5. La forme des lames d'insertion et le nombre de leur échancrures ou dents.

" 6. Enfin la disposition des couleurs de la coquille."—*D. S. N.* xxxvi. 536.

Certainly this was a great improvement to what had been previously done, but unfortunately M. De Blainville appears to have had the opportunity of observing only a limited number of species, and has placed the others in the sections to which, from their external appearance, they appeared to belong, though on examination they have not the characters assigned to the division in which they were placed: thus *Chiton amiculatus*, p. 546, is said to have the front and hinder valves lobed and pectinated; *C. niger*, p. 541, the teeth of insertion pectinated; *C. echinatus*, p. 550, the anterior and posterior valve toothed; and *C. gigas*, the lobes not pectinated.

From repeated examination and comparison I am inclined to consider the following as the best characters for the distinction of the genera and species, arranged according to their permanence and importance.—

1. The presence or absence of the pores, furnished with a bundle of spicula on each side of the mantle.
2. The comparative length and position of the gills.
3. The form and modification of the plate of insertion of the valves, especially of the posterior valve.
4. The size and form of the exposed part of the valve, and the kind of sculpture on its surface.
5. The absence or presence of appendages on the mantle, and the form, sculpture on the surface, disposition, and equality or inequality of size of these appendages.
6. The colour of the valves and appendages of the mantle.

It has been objected, that the character derived from the form of the plates of insertion can only be seen by the destruction of the specimens, as they are generally kept in the cabinets: this is not always the case, for they can generally be seen from the under-side or through the substance of the mantle; but when this is not the case, the form of the plates of insertion can be easily discovered by carefully paring away the under part of the mantle, so as to show part of the edge of the valve without any injury to the specimen. And it should be recollected too, that the separate valves are the only part of the molluscous animals which are usually kept in cabinets.

The number of lobes into which the edge of the margin of insertion is divided may be also easily seen by the porous lines which are to be observed on the inner surface of the valves, diverging from the apex to the margin, each of these lines going to the bottom of the notch which separates the lobes on the inner processes of insertion.

Various authors, as Spengler, Chemnitz, De Blainville, Sowerby, Barnes and Reeves, have described and figured many species of the genus.

Synopsis of the Genera.

I. *Mantle simple, without any pores or tuft of spines on the sides.*

A. *The plate of insertion of the anterior and posterior valve divided into several lobes, and of the central valves into two lobes.*

a. *The valves exposed, broad, with regular, equal, well-defined margin for insertion, divided into lobes more or less denticulated. The hinder valve with the apex superior, subcentral.*

1. Chiton. The posterior valve entire; margin covered with regularly-disposed imbricate scales.

2. Tonicia. Posterior valve entire; margin naked.

3. Acanthopleura. Posterior valve entire; margin spinose, spinulose or bristly.

4. Schizochiton. Posterior valve with a deep notch on its central hinder margin; mantle slit behind.

b. *The valves exposed, broad; the hinder valve with a slightly raised, smooth or slightly crenated plate of insertion (not divided into lobes on the sides), and with the apex subterminal.*

5. Corephium. The hinder valve with a rather raised apex, and the plate of insertion crenulated, with one small central slit.

6. Plaxiphora. The hinder valve with a produced posterior apex, and the plate of insertion entire, smooth, rounded; valves thin; mantle with tufts of bristles.

7. Onithochiton. The hinder valve with a produced terminal apex; plate of insertion entire, rounded; valves thick; mantle covered with spines, bristles, or chaff-like scales.

8. Enoplochiton. The hinder valve with a produced terminal apex; plate of insertion entire, rounded; valves thick; mantle covered with oblong, unequal, elongated, oblong scales.

B. *The plate of insertion of all the valves with only a single notch on each side. The valves more or less covered; the hinder valve with expanded plates of insertion (as in the central valves), with only a single notch on each side, and a concave sinuosity below.*

9. Mopalia. Valves, exposed part broad, transverse; plates of insertion moderate; mantle spinulose; front edge sometimes expanded.

10. Katharina. Valves, exposed part small, cordate, as long as broad; mantle smooth.

11. Cryptochiton. Valves entirely hidden; mantle covered with tufts of spicula.

II. *Mantle with a series of pores (each furnished with a tuft of spines) on each side. The plates of insertion of all the valves with only a single notch on each side, which is sometimes rudimentary.*

12. Cryptoconchus. Exposed part of valves very small, linear, much longer than broad; mantle smooth.

13. Amicula. Exposed part of valves small, subcordate, as broad as long; mantle bristly.

14. Acanthochites. Exposed part of valves moderate, broad cordate, as long as broad; mantle spinulose.

15. Chitonellus. Exposed part of valves linear-lanceolate, elogate; body vermiform; mantle spinulose.

1. Chiton, *Linn.* (part), *Guilding, Z. J.* v. 27; *Swainson*; *Gray, Syn.*

Lepidopleurus, "*Leach MSS.,*" *Risso, Eur. Merid.* 267. Chiton, sect. A. 1. *Blainv.* Lepas spec., *Adanson.* Corephium, *Brown.* Lophurus, *Poli.* Gymnoplax, *Gray.*

* *Scales of the margin moderate, smooth, polished; valves thickish.*

Ch. striatus, *Barnes.* Ch. olivaceus, *Frembly, Sow. C. Ill.* f. 3, 41. Chiloe.
Ch. Cumingii, *Frembly, Sow. C. Ill.* f. 32, 51. Chili.
Ch. albolineatus, *Sow. C. Ill.* f. 39. Mexico.
Ch. squamosus, *Linn.* Ch. bistriatus, *Wood.* Ch. obscurus, *Sow.* West Indies.
Ch. sulcatus, *Wood, Sow. C. Ill.* f. 12.
Ch. granosus, *Frembly.* Chili.
Ch. Barnesii, *Gray.* Coquimbo.
Ch. glaucus, *Gray, Spic. Zool.*=Ch. viridis, *Quoy.*
Ch. granulosus, *Frembly.* Conception.
Ch. Siculus, *Gray.* Ch. Polii, *Desh.* Sicily.
Ch. lyratus, *Sow. C. Ill.* f. 126.
Ch. foveolatus, *Sow. C. Ill.* f. 60.
Ch. excavatus, *Gray, Sow. C. Ill.* f. 131.
Ch. fasciatus, *Wood, Sow. C. Ill.* f. 153.
Ch. australis, *Sow. C. Ill.* f. 46.
Ch. Stokesii, *Brod., Sow. C. Ill.* f. 24.
Ch. virgulatus, *Sow. C. Ill.* f. 132.
Ch. patulus, *Sow. C. Ill.* f. 134.
Ch. marmoratus, *Gmelin, Sow. C. Ill.* f. 148. West Indies.
Ch. evanidus, *Sow. C. Ill.* f. 139.
Ch. articulatus, *Sow. C. Ill.* f. 18. California.
Ch. lævigatus, *Sow. C. Ill.* f. 18*. California.
Ch. Goodallii, *Sow. C. Ill.* f. 50. Galapagos.

** *Scales of the mantle small, smooth, polished.*

Ch. Bowenii, *King, Sow. C. Ill.* f. 37. Magellan Str.

*** *Scales of the margin transversely grooved; valve rounded, not keeled, thin.*

This section forms a very natural group.

Ch. textilis, *Gray, Spic. Zool.*=Ch. longicymba, *Blainv., Quoy.*

Ch. Indicus, *Sow. C. Ill.* f. 55. Ch. Solea, *Sow. C. Ill.* f. 61. Cape of Good Hope.

Ch. Magdaliensis, *Hinds.*

**** *Scales of the margin lanceolate, elongate, erect, closely pressed.*

Ch. lævis, *Mont.*=Ch. corallinus, *Risso.*

2. Tonicia, *Gray, Syn.* Chiton, *Risso, E. M.* 267.

* *Valves broad, transverse.*

T. atrata. Ch. atratus, *Sow. C. Illust.* f. 57, 58. Falkland Islands.

T. elegans. Ch. elegans, *Frembly, Sow. C. Illust.* f. 73, 74. Ch. Chiloensis, *Sow.* Ch. lineolatus, *Frembly.* Ch. graniferus, *Sow.* Ch. Sparius, *Sow.* Conception Bay.

T. rubra. Ch. ruber, *Linn.* Ch. marmoreus, *O. Fab.* Ch. latus, *Lowe.* Ch. fulminatus, *Couth.*

T. fulva. Ch. fulvus, *Wood, Sow. C. Ill.* f. 53. Cadiz.

T. lineata. Ch. lineatus, *Wood, Sow. C. Ill.* f. 77.

T. Swainsonii, *Sow. C. Ill.* f. 5. Peru.

T. cerasina.

T. lævigata. Ch. lævigatus, *Flem.*

T. lyrata.

T. Grayii. Ch. Grayii, *Sow. C. Illust.* f. 8—16. Peru.

T. castanea. Ch. castaneus, *Wood, Sow. C. Illust.* f. 114, 115, 116. Cape of Good Hope.

T. fastigiata. Ch. fastigiatus, *Gray, Sow. C. Illust.* f. 11. California.

** *Valves moderate, subcordate, rounded, and far apart on the sides; lobes of insertion wide; mantle broad.*

T. disjuncta. Ch. disjunctus, *Frembly, Zool. Journ.* t. 77. f. 5, forms the passage to the Chitons, which have only a small part of the valves exposed.

3. Acanthopleura, *Guild. Z. J.* v. 27; *Gray, Syn.*

Canthapleura, *Swains.*

This genus gradually passes to *Onithochiton.*

* *The plate of insertion of the hinder valve well-developed, regular; valves thin; lateral area distinct; margin bristly.*

A. Peruviana. Ch. Peruvianus, *Lam., Sow. C. Ill.* f. 44. Peru.

A. bicolor. Ch. bicolor, *Adams.* West Indies.

A. Hennahi. Ch. Hennahi, *Gray, Sow. C. Ill.* f. 1 & 33.

A. Watsonii. Ch. Watsonii, *Sow. C. Ill.* f. 81, 82, 130 = Ch. castaneus, *Quoy.*

*** The plate of insertion of the hinder valve narrow, rather irregular.*

† Margin bristly; lateral area distinct.

A. nobilis, *Gray*. New Zealand.

†† Margin spinose or spinulose; lateral area indistinct.

A. picea. Ch. piceus, *Sow. C. Ill.* f. 147. West Indies.
A. spinigera. Ch. spinigerus, *Sow. Conch. Ill.* f. 68. Peru.
A. Owenii, *Gray*. West coast of Africa.
A. spinosa. Ch. spinosus, *Brug.*, *Sow. C. Illust.* f. 151. Australia.
A. brevispinosa. Ch. brevispinosus, *Sow. C. Illust.* f. 136. Island of Johanna.
A. magnifica. Ch. magnificus, *Gray, Sow. C. Illust.* f. 52.

††† Margin smooth?; lateral area very distinct.

A.? gigas. Ch. gigas, *Gmel.* Cape of Good Hope.
A.? truncata. Philippines.

4. SCHIZOCHITON.

Valves elongate, subcordate, narrow; lateral area short, distinctly defined; the hinder valves large, with a subposterior superior apex and a deep notch on its hinder lower edges, and the plate of insertion small, with a few oblique notches, scarcely pectinated. Mantle broad, covered above with small chaff-like scales, deeply notched behind.

Schizochiton incisus. Chiton incisus, *Sow.* Philippines.

5. COREPHIUM.

Valves broad; wing of insertion of the anterior valve lobed and pectinated; the hinder valve oblong, with a subcentral, subposterior, not produced apex; the edge of insertion distinct, not lobed on the sides, with a single nick behind, and slightly denticulated; mantle spinose.

C. echinatus. Chiton echinatus, *Barnes*. C. tuberculiferus, *Sow.* Ch. spiniferus, *Frembly*; *Sow. C. Illust.* f. 47, young.

6. PLAXIPHORA.

P. Carmichaelis. Chiton Carmichaelis, *Gray, Spic. Zool.* Ch. albidus, *Blainv.* 547. Ch. raripilosus, *Blainv.* 547. Ch. costatus, *Blainv.* 547. Ch. biramosus, *Quoy, Voy. Astrol.* t. 74. f. 12, 16. Ch. setiger, *King, Z. J.* v. 338; *Sow. Conch. Ill.* f. 17. Ch. Fremblii, *Brod. P. Z. S.* 1832, 28; *Sow. Conch. Ill.* f. 2. Ch. setosus, *Sow.*, *Beechey Voy.* Terra del Fuego.

See also Ch. setosus, *Sow. C. Ill.* f. 19?

7. ONITHOCHITON.

O. Gaimardi. Chiton Gaimardi, *Blainv.* 546.
O. hirtosus. Chiton hirtosus, *Blainv.* 546.
O. undulatus. Ch. undulatus. Van Diemen's Land.

8. ENOPLOCHITON.

E. niger. Ch. niger, *Barnes*. Ch. Coquimbensis, *Frembly*. Coquimbo.

The valves become very much eroded.

9. MOPALIA.

Valves broad, transverse, depressed; margin of insertion moderate; the hinder valve with a rounded lobe on the hinder edge; mantle moderately broad, bristly above, narrow behind.

* *Margin moderately wide in front.*

M. Hindsii. Ch. Hindsii. West coast of America.
M. Simpsonii. Ch. Simpsonii, *Gray*. Brit. Mus.

** *Margin very wide in front.*

M. Blainvillii. Ch. Blainvillii, *Sow. C. Ill.* f. 6. Inner Lobos Island.

10. KATHARINA.

K. tunicata. Chiton tunicatus, *Wood, Conch.* ii. t. 2. f. 1; *Cat.* t. 1. f. 10. Wood's specimen is now in the British Museum.
K. Douglasiæ. Ch. tunicatus, *Sow. C. Illust.* f. 152. California.

11. CRYPTOCHITON.

The gill only occupies the hinder part of the sides.

C. amiculatus. Ch. amiculatus, *Pallas, Nov. Comm. Petrop.* ii. 241. t. 7. f. 26, 30; *Sow. Tank. Cat.* (spec. Brit. Mus.); *Wood, Cat.* t. 1. f. 12, inner side of shell; *Sow. Conch. Illust.* f. 80, half-grown. Chiton Sitkensis, *Reeve's Conch. Icon.* f. 55, adult. Kurile Islands.

12. CRYPTOCONCHUS, *"Blainv.," Swainson*; *Gray, Syn.*

Body oblong, rather convex; back flattish or concave in the centre, with the tuft of spines on the upper part of the sides of the back. The gills extend about half the length of the sides.

Cryptoconchus porosus, *"Blainv.," Burrows, Elem. Conch.* 190 (1815), spec. Brit. Mus. Chiton porosus, *Burrows, E. C.* t. 28; *Wood, Cat.* t. 1. f. 39. Ch. Leachii, *Blainv. D. S. N.* 554, spec. Brit. Mus. Ch. monticularis, *Quoy, Voy. Astrol.* t. 73. f. 30, 34, 36, and lower fig. 7; *Sow. Conch. Illust.* f. 129, valves. New Zealand.

13. AMICULA, *Gray, Syn.* 1840.

Body ovate, convex; back convex; mantle bristly.

Amicula vestita. Chiton vestitus, *Sow. Zool. Journ.* iv. 368; *Sow. Conch. Illust.* f. 128. Ch. Emersonii, *Couthoy*. Atlantic Ocean.

14. ACANTHOCHITES, *Leach, B.M.*; *Gray, Syn.*

Acanthochites, *"Leach."* Acanthochitus, *Risso*. Phakellopleura, *Guild., Swainson*. Chitonellus (part.), *Guild.* Acanthochiton, *Herrm.*

Body oblong, elongate, rather depressed; mantle spinulose; tuft of spines generally large ; gill extending about two-thirds the length of the sides.

M. De Blainville says, the valves of this genus are always without any trace of lateral area (*D. S. N.* xxxvi. 537), but this must have arisen from his only having examined worn specimens.

A. fascicularis. Ch. fasc., *Linn.* C. echinites, *Blainv.*, *Sow. Conch. Ill.* f. 87—93.

A. Garnoti. Ch. Garnoti, *Blainv. D. S. N.* 552 ? ; *Quoy, Voy. Astrol.* t. 73. f. 9, 14. Asc. Zelandica, *Quoy, Voy. Astrol.* t. 73. f. 5. A. Hookeri, *Gray, Dieffenbach,* 262.

A. polychetus. Ch. polychetus, *Blainv.* 553.

A. roseus. Ch. roseus, *Blainv.* 553.

A. Lesueurii. Ch. Lesueurii, *Blainv.* 553.

A. scaber. Ch. scaber, *Blainv.* 553.

A. violaceus. Ch. violaceus, *Quoy, Voy. Astrol.* 73. f. 13, 16, 17, 20; not *Sow. Ill.* f. 133.

A. hastatus. Ch. hastatus, *Sow. C. Ill.* f. 127.

A. hirundiniformis. Ch. hirundiniformis, *Sow. C. Ill.* f. 148.

A. strigatus. Chitonellus latus, *Guild. Z. Journ.* v. 28. Chitonellus strigatus, *Sow. C. Ill.*

15. Chitonellus, *Lam.*

Chitonella, *Desh.* Cryptoconchus, "*Blainv.*," *Burrows.* Cryptoplax, *Blainv.* Chitoniscus, *Herrm.*

Body elongate, compressed, convex above; mantle covered with crowded spines; the exposed part of the front valves oblong, square, broad, often worn; of the hinder ones narrow, lanceolate; the plates of insertion large, produced in front, and scarcely notched on either side. The gills occupy the hinder third of the sides.

M. De Blainville inserts Lamarck's species of Chitonelli with the spiny Chitons in section D., and in section E. he redescribes them, from specimens in spirits in the British Museum.

Chitonellus lævis, *Lam.* Chiton vermiformis, *Blainv. D. S. N.* xxxvi. 553. Oscab. fascie, *Quoy, Voy. Astrol.* t. 73. f. 21, 29. Cryptoconchus larvæformis, "*Blainv.*," *Burrows, Elem. Conch.* 190. t. 28. f. 2, 4; *Wood, Cat.* t. 1. f. 40. Philippines.

Chitonellus striatus, *Lam.*; *Sow. Conch. Illust.* f. 62 ? Oscab. ocule, *Quoy, Voy. Astrol.* t. 73. f. 37, 38. Australia.

The fossil Chitons of the older strata described by Munster, more lately by Ryckholt, *Bull. Acad. Brux.* 1845, xii. 36. t. 1—4, appear to belong to a peculiar genus, which may be called *Gryphochiton,* most nearly allied to *Chitonellus.*

I have described some peculiarities in the development, disposition and structure of the valves of the Chitons in a paper which will be read at the Royal Society on the 16th of June next.